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CELERY ROOT ROT.

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In 1904, there was reported from one of the Ohio celery districts, a serious root rot of celery. This included, in the final stages, the complete decay of the root, leaving only the crown, usually in the form of an inverted cone (Figure 2). This remaining root portion is of a black or dark brown color. The celery can be easily lifted from the ground. The disease next extends to the base of the outer leaf stalks, which, in turn, die as shown in Figure 1, *b*.

A certain celery grower stated that the disease first appeared in 1902, on a part of a plot used for seven years in growing celery. The portion of the plot affected was at the edge and included only a few rows. In 1903, it had spread to half an acre. In this place, practically all the celery became like that shown in Figure 2. On this same farm, in 1904, a whole plot of three acres was affected, involving a loss of nearly four-fifths of the crop.

The varieties planted were Golden Self Blanching (which is early, maturing from the middle of August to the first of September) the Giant Paschal and Evan's Triumph. The last two are late, maturing as late as December 1st. They are much freer from this form of root rot, but they are not so desirable, on account of their coarseness, being large and requiring extra labor in blanching, which must be done by ridging with dirt.

FIGURE 1. *a*, plant with a normal root; *b*, plant with Root Rot. (Much reduced.)

APPEARANCE ON PLANTS.

Affected plants never attain full size. In Figure 1, the one on the left is practically of normal growth and has attained the proper size. The one on the right is a typically diseased plant, and its size may be determined by comparison with the healthy one at its side. They are always lower and the stalks smaller.

FIGURE 2. The lower portion of two celery plants showing the effects of Root Rot. (Somewhat reduced.)

In the latter part of August it was ascertained by the grower that disease was present. At this time the plants were not making the usual growth, and an examination of the roots showed considerable decay. A further examination of neighboring plants, whose tops were still apparently normal, showed traces of root discoloration. The disease seems to affect the main roots rather than the fibers. They rapidly rot off near the crown, so that the plants may be readily taken from the ground. Sometimes a few of the larger roots may be severed an inch or two from the crown, which, for the most part, alone remains and tapers to a more or less rounded point, as in Figures 2 and 3. In Figure 3, *b*, one of the largest roots,

The money loss of this grower was severe. In 1904, the returns should have been, at best, $400 per acre, or a good average of $300; but the crop gradually decreased to 20 per cent of this sum from 1902 to 1904. The loss came from the much reduced size of the bunches, as well as from the fact that the buyers are guided by looks to a great extent. Yet the bunches are of good quality if not harvested too late, as it is the tender heart-stalks that remain. though dead, remains attached. The exterior of the crown is covered with dead tissue and continues to decay slowly. This finally reaches the base of the outer leaves, as can be seen in Figure 3. The leaves turn brown, fall over and quickly rot (Figure 1, *b*).

Though the decay of the roots is complete, there are cases, especially among younger plants, where new roots appear. This is well shown in Figure 3. Such plants as these never recover; but by aid of such roots, retain life for a lengthened period and even make some growth. These plants were collected early in July. This is unusually early for such advanced stages of the disease, but these plants were started in-doors for the early market.

CAUSES OF ROOT ROT.

So far as is known to the writer, no mention has previously been made of this disease. It is quite different from what has been described as Black Rot. Heart Rot is likewise quite a distinct thing; it affects the part least affected by the Root Rot.

As this disease appeared in soil on which celery had been grown for many successive, years and had been increasing in severity for some years, it was suspected that some parasite was responsible. Rhizoctonia was found on may of the roots and, in many cases, extended even into the browned tissue beyond the decayed parts. Likewise, threads of this fungus were found in the decayed tissues of the outer leaves. But the writer, after a careful study of this fungus, cannot believe that it is alone responsible for the trouble; at least, not in the beginning. Neither could any of the bacteria, which were isolated from the diseased parts, be associated with the cause. Though a number of inoculations were made, none produced disease in the plant.

In order to determine whether there was a possibility of the disease being introduced through the seed, notes were made as to the prevalence of the rot on plants grown from seed obtained from several sources. No relation could be established.

Suggestions as to rotation were made for the 1905 crop. The seed beds were of soil not before used for growing celery. The main part of the crop was planted on similar soil. Though this crop was much freer from the trouble, it was noted that the disease was still present in patches here and there. The diseased spots seemed always to occur where the ground was slightly lower, or where it was not well tiled. No difference could be found in celery grown on the old plots from that grown on the new plots. On a celery farm near Akron, Ohio, the same disease was found, but only to a limited extent and the owner did not consider it serious. It occurred on this farm likewise where the ground was slightly lower and not so well drained.

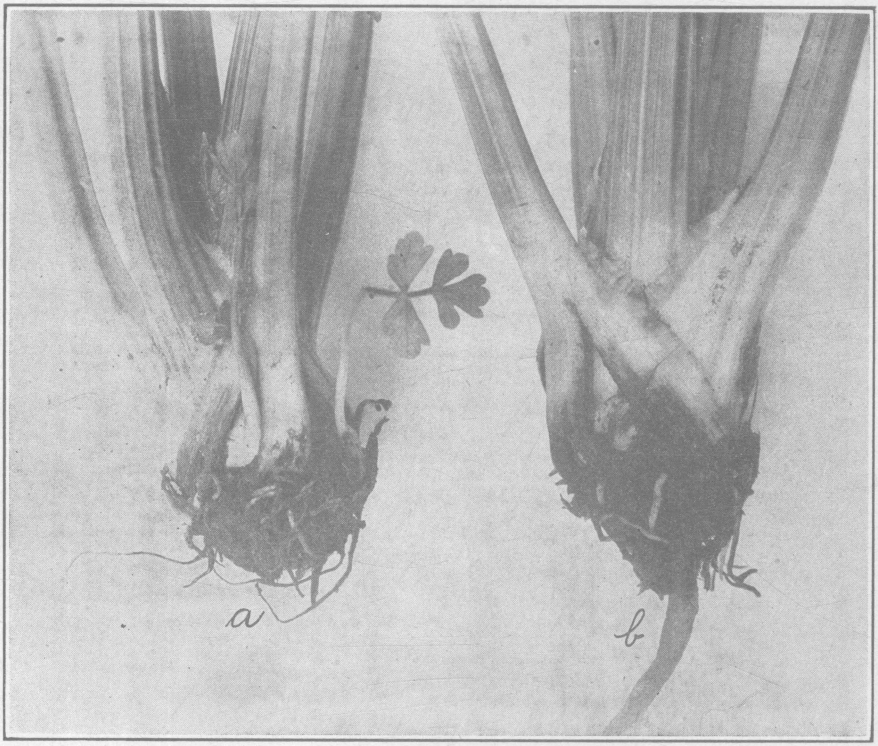

FIGURE 3. Younger plants are often kept alive by new roots, though they increase but little in size. (Slightly enlarged.)

A similar, if not identical form of root rot came under the observation of the writer in New York state in 1903, but no detailed study of it was made at the time. However, the owner of this place

later informed me that the disease had largely disappeared, after causing serious loss for a few years. He also stated that more than the usual amount of rainfall occurred during this period.

PREVENTIVES.

It seems clear, that whatever part Rhizoctonia plays in celery Root Rot, in the later stages of decay with which it is known to be associated, the primal cause is to be found in poorly drained soil. The increase in severity, for the three years mentioned, and it subsequent decrease, are doubtless due to such soil condition caused largely by excessive rains at critical times. More thorough underdrainage, with sufficiently deep main ditches, is suggested as the best preventive.

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